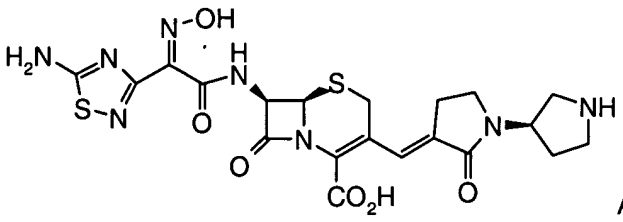
AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions of claims in the application.

LISTING OF CLAIMS:

Claims 1-2 (cancelled)

3. (new) A process for producing a vinylpyrrolidinone-cephalosporin derivative of formula A-1



A-1

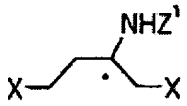
A-1

wherein

* denotes a center of chirality;

comprising:

(a) converting a compound of the formula II

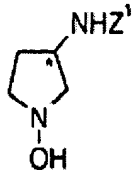


II

wherein
X is a protected hydroxy group;

Z^1 is an amino protecting group; and * is as above

in the presence of hydroxylamine or an acid addition salt thereof into the N-hydroxy-pyrrolidine derivative of the formula III

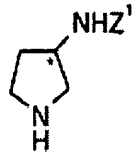


III

wherein

Z^1 and * have the same meaning as above;

(b) reducing said N-hydroxy derivative of formula III to the secondary amine derivative of formula IV



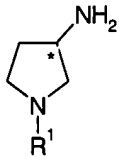
IV

wherein

Z^1 and * have the same meaning as above

by hydrogenation with Raney nickel;

(c) converting said secondary amine of formula IV into a 3-amino pyrrolidine compound of formula I



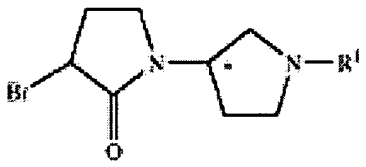
I

wherein

R^1 is an amino protecting group and * is as above;

by reaction of the 1-amino group of the compound of formula IV with a compound of formula R^1X^1, in which R^1 has the above indicated meaning, and X^1 is halogen or a leaving group, and deprotecting the resulting 3-amino group by catalytic hydrogenation;

(d) reacting said 3-amino-pyrrolidine compound of formula I with 2-bromo-4-chlorobutanoylchloride to yield a compound of formula (1)

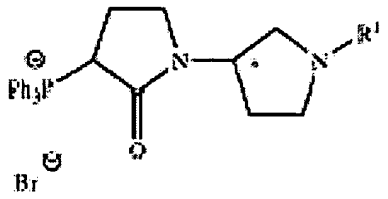


(1)

wherein

R^1 and * have the above indicated meaning

(e) converting said compound into the corresponding triphenylphosphine Wittig salt of formula (2)

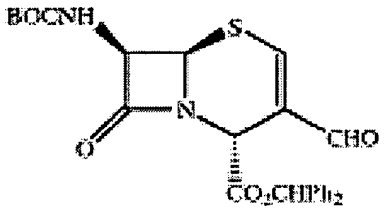


(2)

wherein

Ph is phenyl and R^1 and * are as above ;

(f) reacting said Wittig salt of formula (2) with a diprotected 3-ene cephalosporin derivative of formula (3)



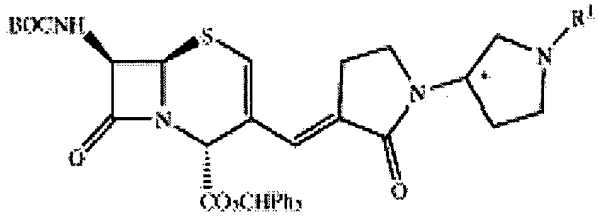
(3)

wherein

BOC is tert.-butoxycarbonyl; and

Ph is phenyl;

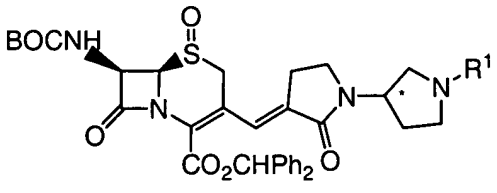
to yield the condensation product (4)



(4)

wherein *, BOC, R^1 and Ph are as above

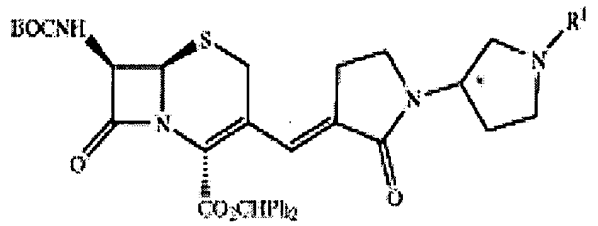
(g) oxidizing said condensation product of formula (4) to produce the 5-sulfoxide compound of formula (5)



(5)

wherein *, R^1, BOC and Ph are as above.

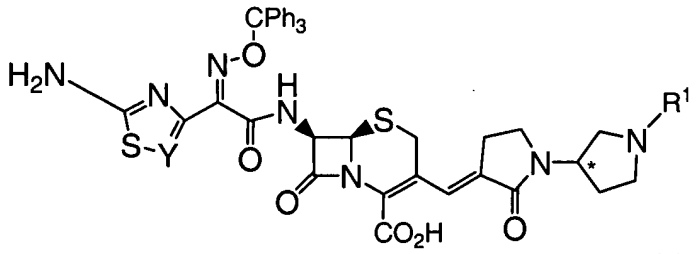
(h) reducing the sulfoxide group on said 5-sulfoxide compound of formula (5) to form the 2-ene celphalosporin derivative of formula (6)



(6)

wherein *, BOC and Ph are as above.

(i) deprotecting the 7-amino group of said compound of formula (6) and acylating the deprotected compound of formula (6) with (Z)-(5-amino[1,2,4]thiadiazol-3-yl-trityloximino-thioacetic acid S-benzothiazol-2-yl ester to yield the compound of formula (9)



(9) (9)

wherein *, R^1 , Y and Ph are as above;

and

(j) removing the protecting amino protecting groups R^1 and CPh_3 from the compound of formula (9) to produce the compound of formula A-1.